**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

**(Our Case No. 03-05)**

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|---|---|
| In the application of: Christopher Lyons et al. | ) |
| Serial No.: 10/790,567 | ) Examiner: Christy L. Novacek |
| Filed: March 1, 2004 | ) Group Art Unit: 2822 |
| For: Patterning with Rigid Organic Under-layer | ) |

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

**INFORMAL DECLARATION UNDER 37 C.F.R. §1.131**

I, Christopher Lyons, hereby declare as follows:

1. I am a co-inventor of the subject matter described and claimed by the above-identified patent application, i.e., United States Application No. 10/790,567 (hereafter the '567 Application). I am currently employed by Advanced Micro Devices, Inc., the assignee of the '567 application, which is located in Sunnyvale, California. I was employed for Advanced Micro Devices, Inc., while developing the invention described and claimed in the '567 Application.

2. The subjected matter recited in the pending claims of the '567 Application was conceived and reduced to practice by the inventors on or before January 22, 2003.

3. Attached as "Exhibit A" is a copy of an Invention Disclosure Form describing the subjected matter recited in the pending claims of the '567 Application. I signed and

dated this document on January 22, 2003, providing factual evidence that the subject matter as recited in the pending claims of the '567 Application was conceived and/or reduced to practice on or before January 22, 2003.

4. All statements made herein and of my own knowledge are true and all statements made on information are believed to be true; and further, these statements were made with the knowledge that willful false statements and like are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that any such willful false statements made may jeopardize the validity of the Application or any patent issuing thereon.

Date: 1/20/06

Christopher Lyons

## CERTIFICATE OF MAILING

The undersigned hereby certifies that the foregoing INFORMAL DECLARATION UNDER 37 C.F.R. §1.131 is being deposited in the United States Postal Service, as first class mail, postage prepaid, in an envelope addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 24th day of January, 2006.

Monica H. Choi
Reg. No. 41,671

"Exhibit A"

**AMD INVENTION DISCLOSURE** TLD ID# H2004 Rec'd date _____

California & Asia: x42110, return to MS68; Texas: x55964 return to MS562; Dresden & Europe: x83401 Silke Kretzschmar at MS E21-PP.

**This invention applies to:** **Project:** ☐, **Product:** ☐, **Process:** X, **Technology** X **Other** ☐,
*IMPORTANT Please identify any potential use:* _____

**List 2 to 5 key search words related to the invention:** __Gate pattering, Trim, BARC_____

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**Working title of invention**: __Organic underlayer for enhanced gate trim_____

**Inventor's signature** : C. F. Lyons **date :** 1/22/03
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5 inventors

Witness 1 initial: CAS Witness 2 initial: A.M.

**Co-Inventor's signature :** _____ **date :** 2/3/03

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Division:___TDG____ Directorate:_APD_____ Dept #:7197 Manager: Chris Spence
Residence address:_2250 Monroe # 366, Santa Clara CA 95050

Identify known relevant art (patents, publications, other information): ____Organic polymer BARC's (hereafter refered to as spin-on barc or SOB) have been used in gate patterning since the 0.35 micron technology generation. It is well know that the BARC open etch process can reduce the resist feature width allowing gate patterns smaller than the lithographic limit (hereafter referred to as the Trimmimg). Organic polymer BARC's are highly specialized polymer materials optimized for their coating and optical properties. In most cases the etch properties of SOB's are poor. Silicon nitride based barcs (hereafter refered to as SiN Barc) are known to perform the BARC role equal or better than organic polymer BARCs and to have good etch properties with respect to both the SiN Barc etch and the polysilicon substrate etch. With the SiN's, an etch process analogous to the SOB open is still useful to reduce the resist feature width. In the case of 193nm lithography both the photoresist and the SOB etch properties are poor. This leads to the use of a combination of a SOB with trimming and with another underlying silicon based film ( a hardmask) to help mask the substrate etch. The hardmask film may be an oxide or a nitride of silicon, or another etch resistant material, and need not have antireflective properties.

State the problem solved by the invention:__The limitaions of all trimming processes discussed above are the lack of sufficient photoresist thickness to survive the substrate etch (erosion) and the photoresist's lack of mechanical strength to maintain a stable high aspect ration structure (pattern collapse). By combining an organic film with a SiN or other silicon based BARC, both limitations can be improved._Instead of relying on SOB to control reflectivity SiN BARC serves that role. The organic layer between the resist and the SiN is opened by the trim etch. It provides more masking material for the substrate etch. By optimizing the organic layer for etch and mechanical strength (or stiffness, modulus etc. ) the organic layer extends the CD reduction capability of the trim process. In fact with proper targeting all of the photoresist could be eroded and the patterned organic layer serves as the substrate etch mask. _In the context of our trim model the organic mask improves both the Hmin and the aspect ratio limits.

Examples of organic films include polymer films spin cast from solution and CVD films. Aromatic polymers with a high degree of crystalline character are preferred for their mechanical and etch properties. Examples of useful polymer types include aromatic addition polymers such as polystyrene, substituted polystyrenes and copolymers of styrene with other ethylenic unsaturated monomers, aromatic condensation polymers such as phenol-formaldehyde resins and polyimides, polyamides, and polycarbonates. In general highly crosslinked polymers offer good mechanical and etch properties. Non-aromatic crystalline polymers such as high density polyethylene and high density polypropylene are also preferred for their mechanical strength. CVD films with good mechanical and etch properties include PECVD carbon films deposited from methane, ethane, ethylene, propane, propylene and the like. The organic underlayer may be transparent, partially or fully opaque at the exposure wavelength._____

# *AMD INVENTION DISCLOSURE*

TLD ID# _____ Rec'd date _____

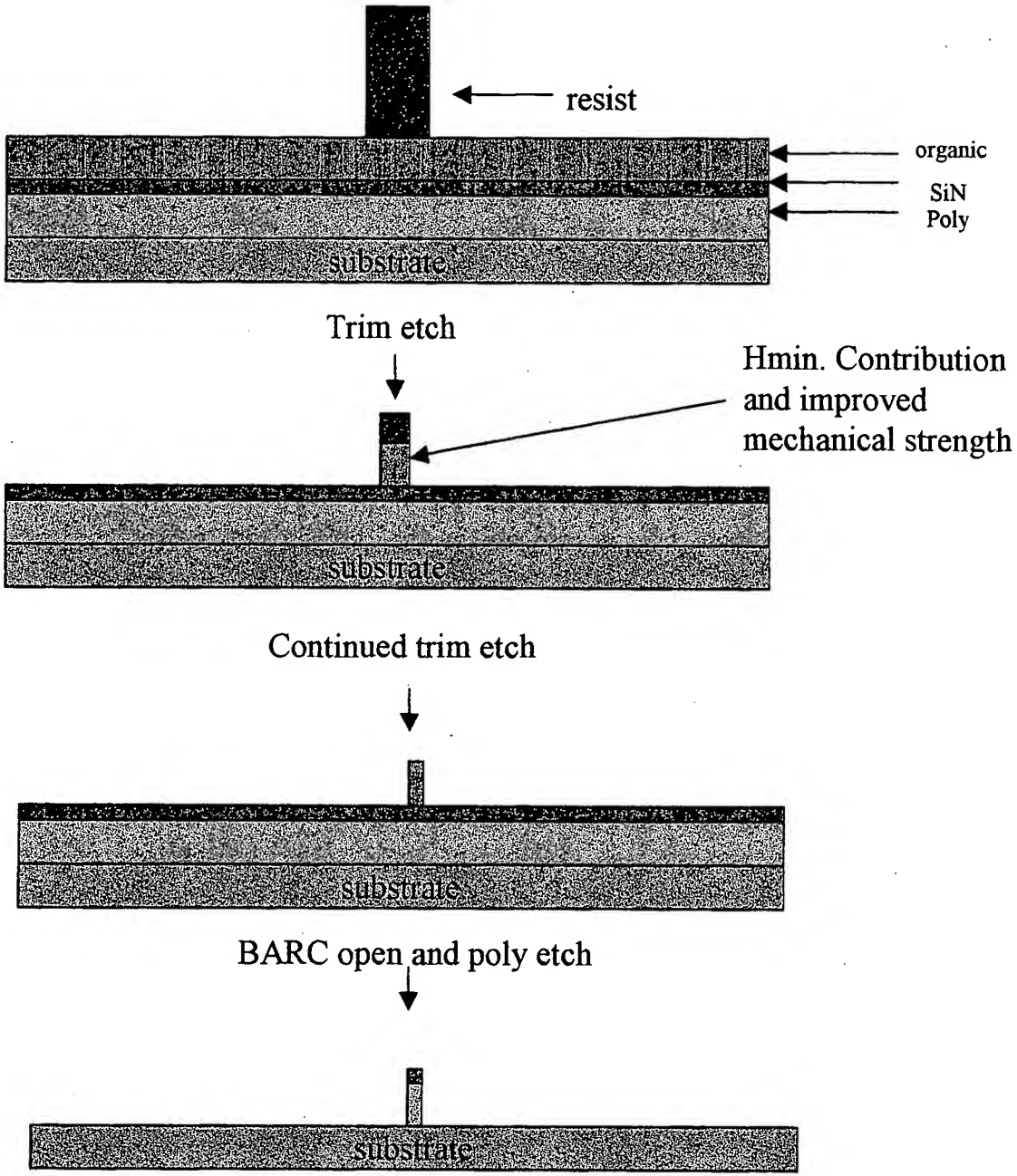
California & Asia: x42110, return to MS68; Texas: x55964 return to MS562; Dresden & Europe: x83401 Silke Kretzschmar at MS E21-PP.

Brief description and sketch of the invention (***please attach*** *copies of documents like AMD patent notebook pages, reports and drawings that are helpful indescribing / understanding the invention*): _____

_____See Powerpoint slide.

Patent notebook # _____ Page numbers_____ Number of drawings_____

Witness 1 initial: CMS Witness 2 initial: A.M.J


resist
organic
SiN
Poly
substrate
Trim etch
Hmin. Contribution
and improved
mechanical strength
substrate
Continued trim etch
substrate
BARC open and poly etch
substrate